Abstract—Due to the limitation of motor driving force, the actuator may fall into the saturated region and lead to the nonlinear situation at each instant of the position commanding. This saturation will cause the positioning response serious delay. A fixed gain anti-windup controller can’t match the requirement of a widely positioning control. In order to realize an accurate and rapid position control system, an adaptive anti-windup controller has designed to the velocity control loop of the linear motors respectively to cope with the various positioning command. By eliminating the windup situation for controlling of the linear motors, the setting time of positioning response has been shortened and it has led the playing performance smooth and rapid.

I. Introduction / Basic operation theory

A. The overall architecture of the piano robot

1. An anthropomorphic music playing robot has implemented.
2. Anti-windup strategy for the PI velocity controller.
3. An adaptive anti-windup controller is designed for the piano robot.
4. Experiment and implementation with a FPGA-based controller have done.

B. The control diagram of the hand driving motor

C. Step response with or without actuator saturation

D. An anti-windup controller design

II. The adaptive anti-windup controller design

A. Simulation about the anti-windup controller design with a fixed gain

B. The optimum anti-windup control gain

C. The experiment results with the FPGA-based controller

D. An anti-windup controller design

III. The works

1. An anthropomorphic music playing robot has implemented.
2. Anti-windup strategy for the PI velocity controller.
3. An adaptive anti-windup controller is designed for the piano robot.
4. Experiment and implementation with a FPGA-based controller have done.